Title: EXHAUST GAS PURIFYING APPARATUS AND METHOD FOR INTERNAL COMBUSTION ENGINE, AND ENGINE CONTROL UNIT
Inventor: Yuji YASUI et al.
Docket Number: 108419-00055

FIG. 1

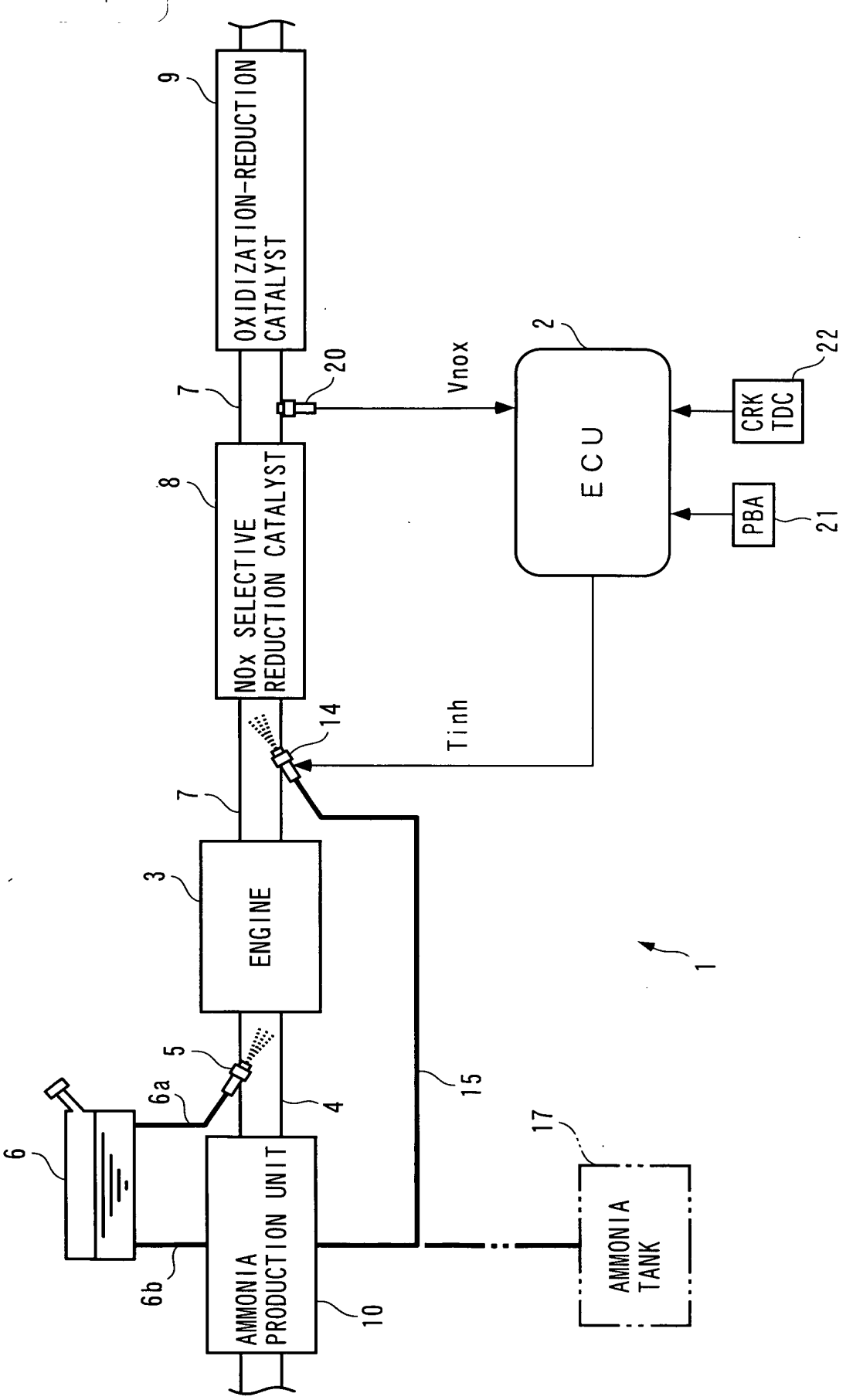

FIG. 2

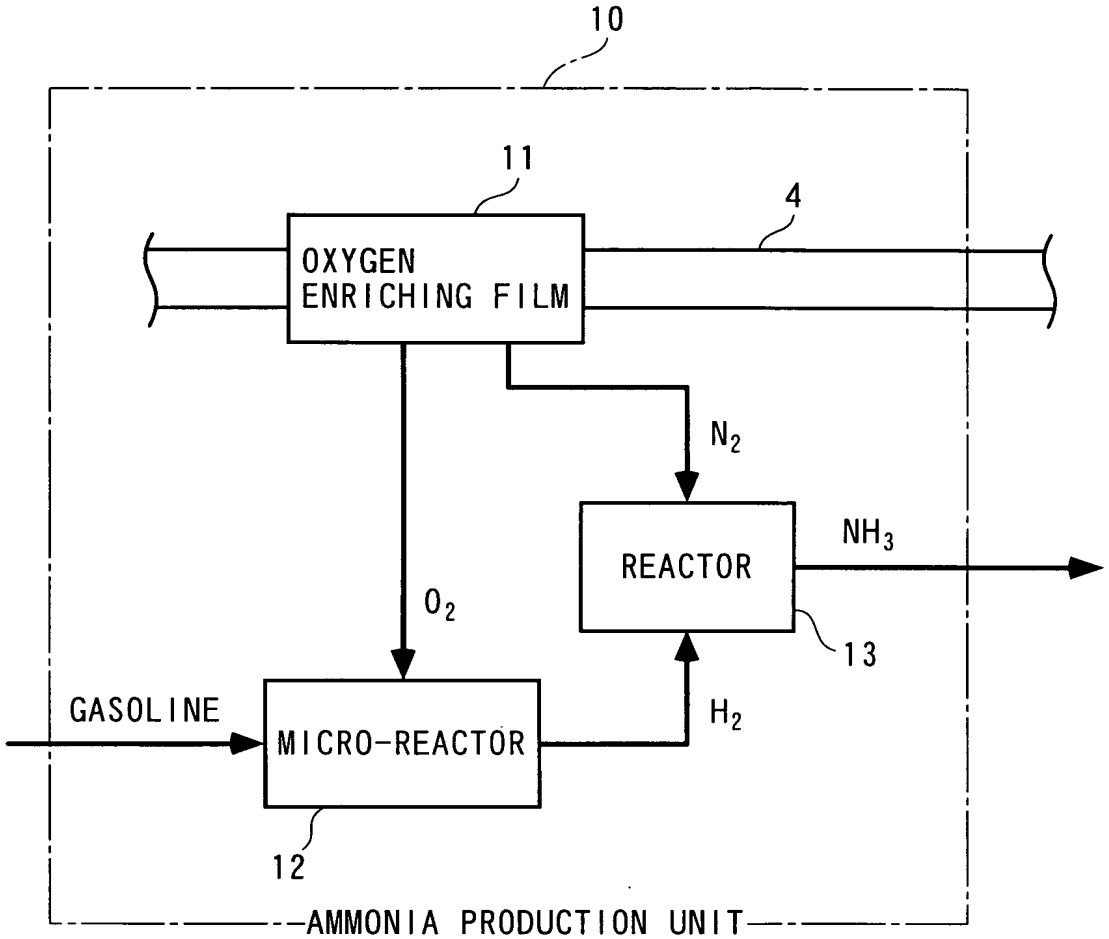
10
11
4
OXYGEN ENRICHING FILM
N_2
REACTOR
NH_3
O_2
13
GASOLINE
MICRO-REACTOR
H_2
12
AMMONIA PRODUCTION UNIT

FIG. 3

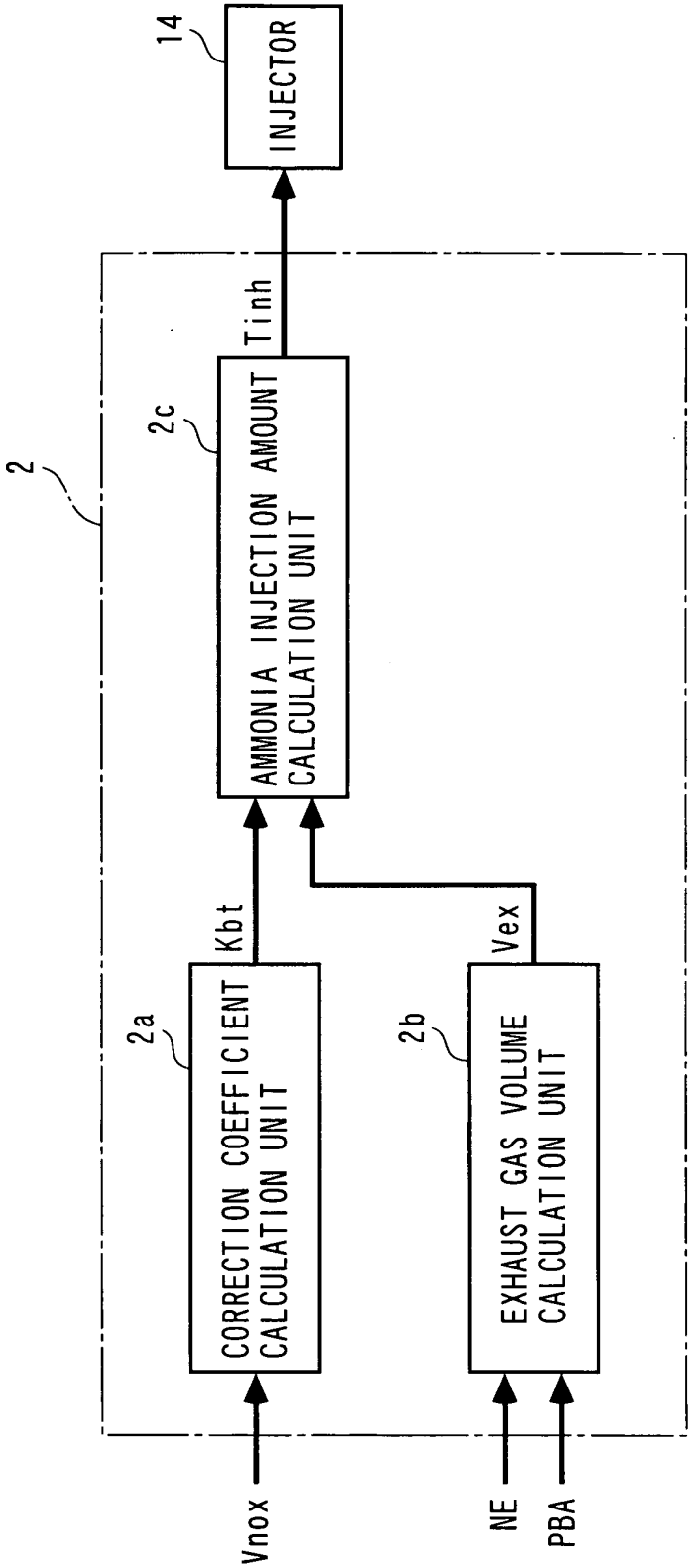
1
2
14
INJECTOR
Tinh
2c
AMMONIA INJECTION AMOUNT CALCULATION UNIT
Kbt
Vex
2a
CORRECTION COEFFICIENT CALCULATION UNIT
2b
EXHAUST GAS VOLUME CALCULATION UNIT
Vnox
NE
PBA

FIG. 4A

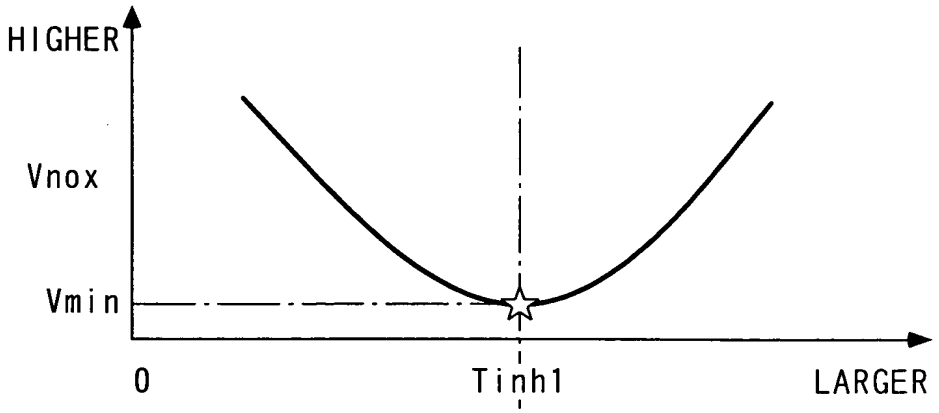
HIGHER
Vnox
Vmin
0
Tinh1
LARGER

FIG. 4B

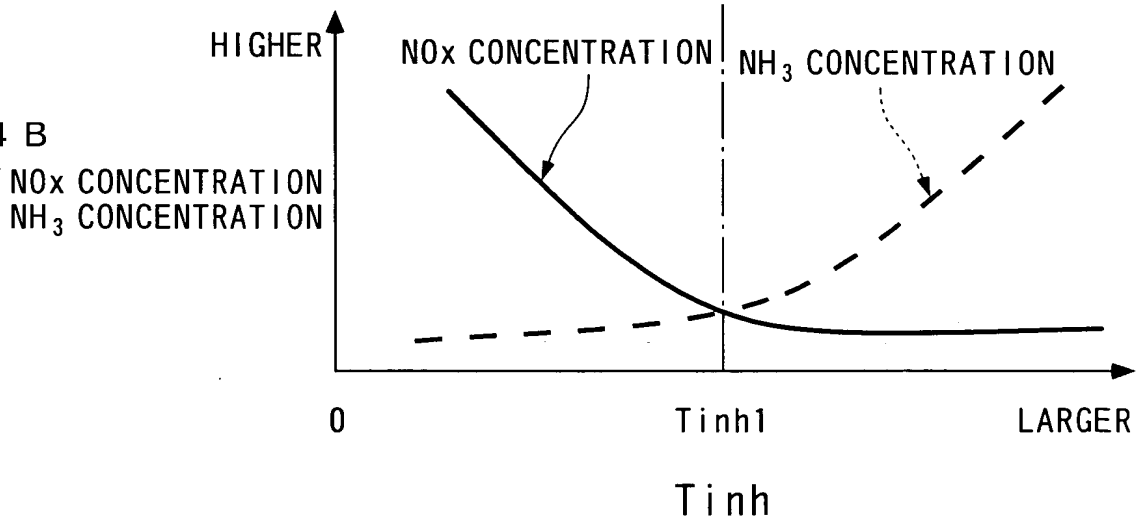
NOx CONCENTRATION
NH3 CONCENTRATION
HIGHER
NOx CONCENTRATION
NH3 CONCENTRATION
0
Tinh1
LARGER
Tinh

FIG. 5A

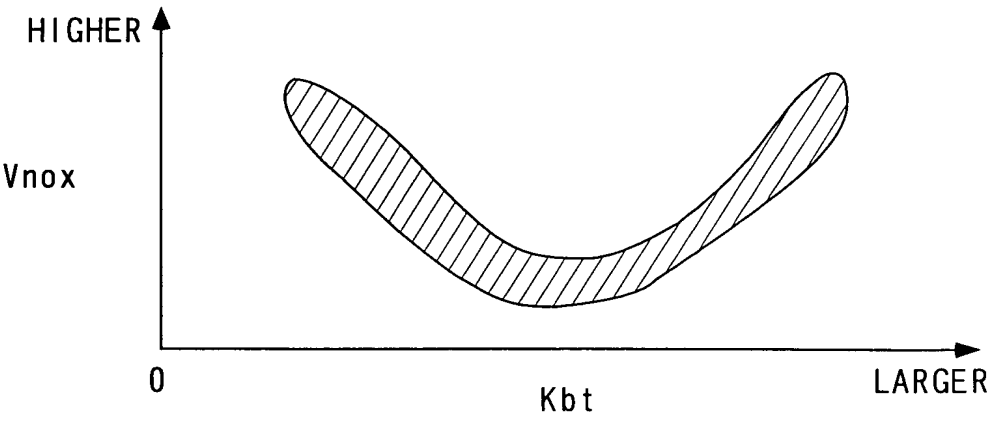
HIGHER
Vnox
0
Kbt
LARGER

FIG. 5B

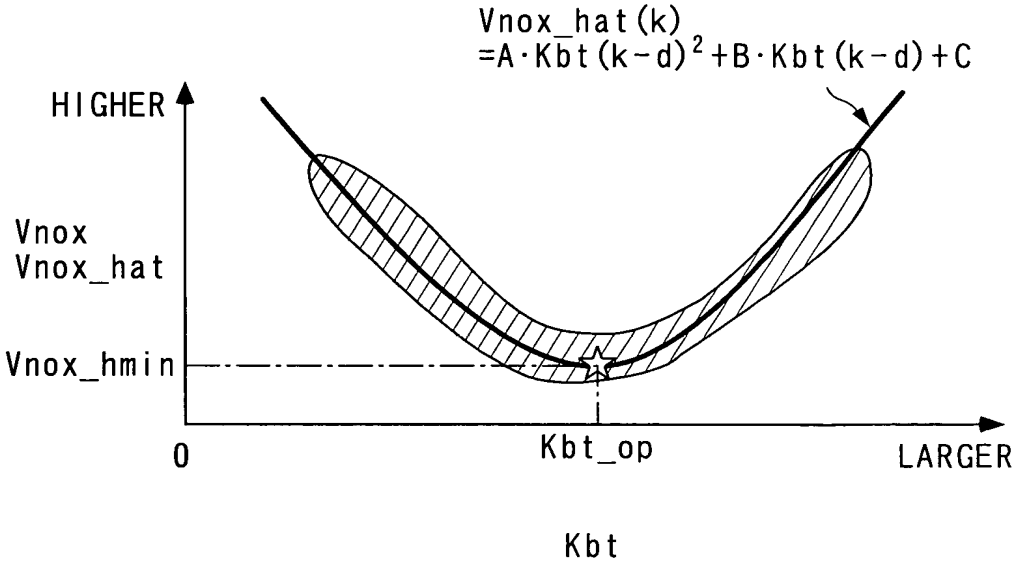
Vnox_hat(k)
=A·Kbt(k-d)²+B·Kbt(k-d)+C
HIGHER
Vnox
Vnox_hat
Vnox_hmin
0
Kbt_op
LARGER
Kbt

FIG. 6

$$Vnox_hat(k) = A \cdot Kbt(k-d)^2 + B \cdot Kbt(k-d) + C \quad \cdots\cdots (3)$$

$$\theta(k) = \theta(k-1) + KP(k) \cdot ide(k) \quad \cdots\cdots (4)$$

$$\theta(k)^T = [A, B, C] \quad \cdots\cdots (5)$$

$$ide(k) = Vnox(k) - Vnox_hat(k) \quad \cdots\cdots (6)$$

$$Vnox_hat(k) = \theta(k-1)^T \cdot \zeta(k) \quad \cdots\cdots (7)$$

$$\zeta(k)^T = [Kbt(k-d)^2, Kbt(k-d), 1] \quad \cdots\cdots (8)$$

$$KP(k) = \frac{P(k) \cdot \zeta(k)}{1 + \zeta(k)^T \cdot P(k) \cdot \zeta(k)} \quad \cdots\cdots (9)$$

$$P(k+1) = \frac{1}{\lambda_1} \cdot \left(I - \frac{\lambda_2 \cdot P(k) \cdot \zeta(k) \cdot \zeta(k)^T}{\lambda_1 + \lambda_2 \cdot \zeta(k)^T \cdot P(k) \cdot \zeta(k)} \right) \cdot P(k) \quad \cdots\cdots (10)$$

I : UNIT MATRIX
λ_1, λ_2 : WEIGHT PARAMETERS

FIG. 7

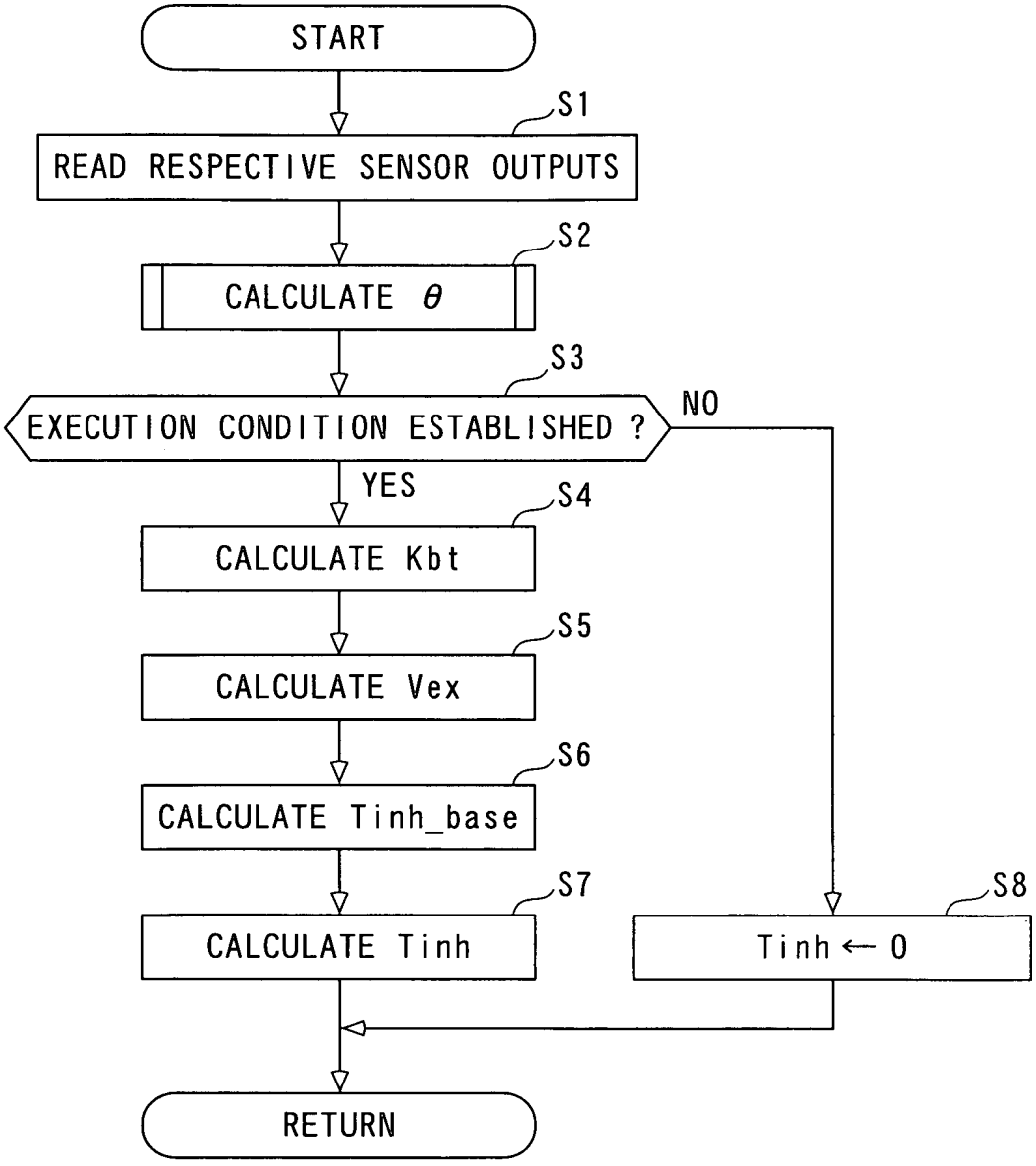
START
S1
READ RESPECTIVE SENSOR OUTPUTS
S2
CALCULATE θ
S3
EXECUTION CONDITION ESTABLISHED ?
NO
YES
S4
CALCULATE Kbt
S5
CALCULATE Vex
S6
CALCULATE Tinh_base
S7
CALCULATE Tinh
S8
Tinh ← 0
RETURN

FIG. 8

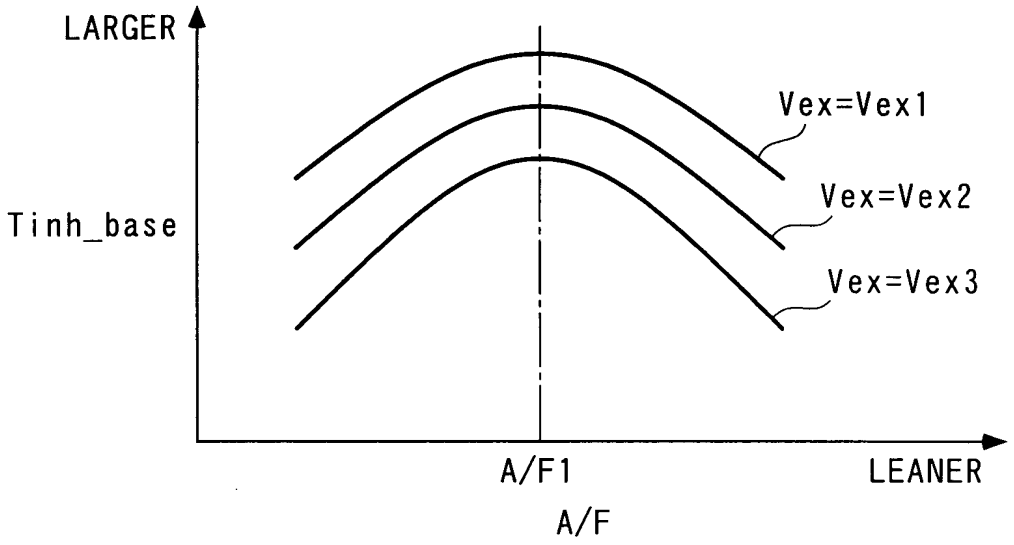

FIG. 9

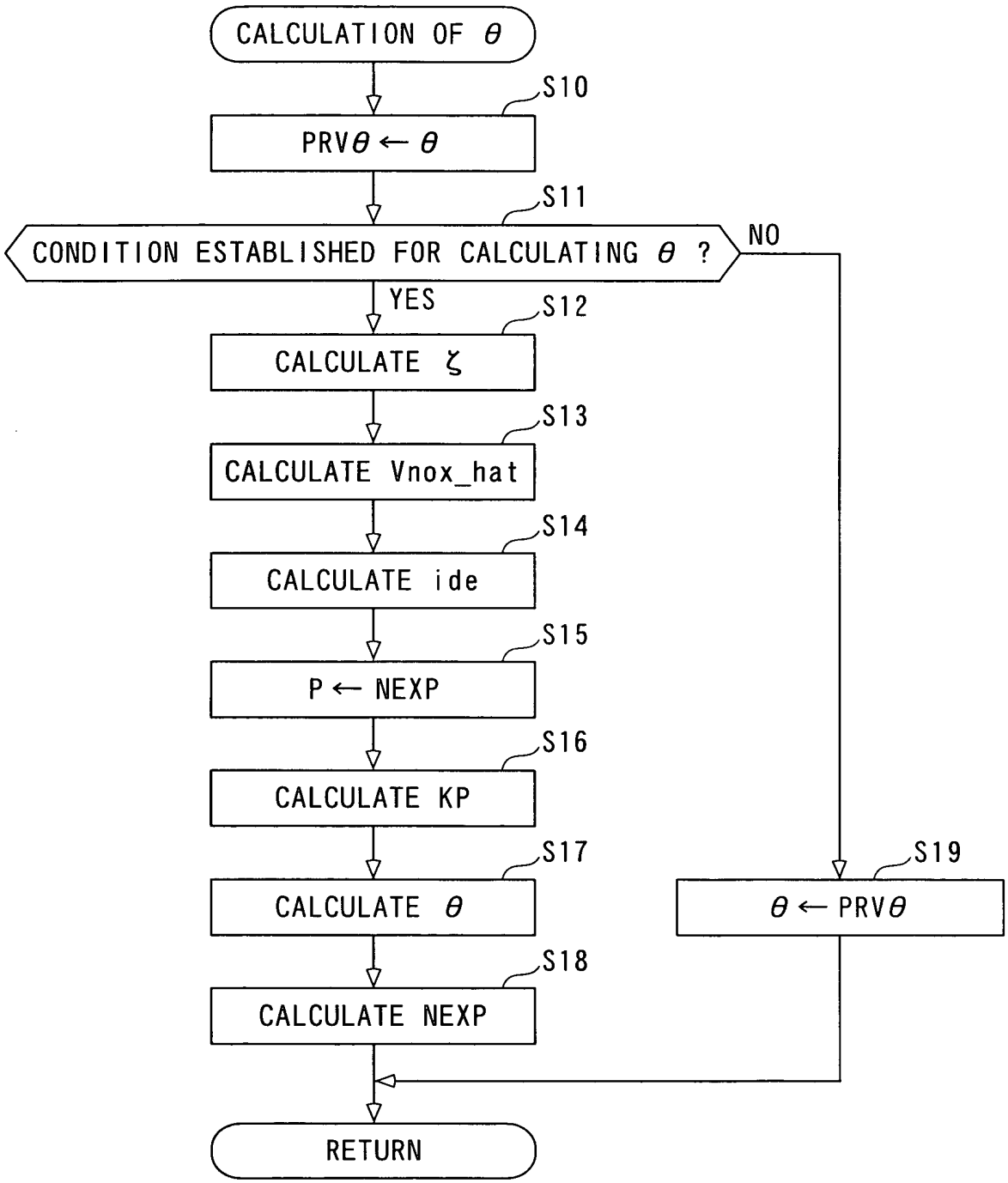
CALCULATION OF θ
S10
PRVθ ← θ
S11
CONDITION ESTABLISHED FOR CALCULATING θ ?
NO
YES
S12
CALCULATE ζ
S13
CALCULATE Vnox_hat
S14
CALCULATE ide
S15
P ← NEXP
S16
CALCULATE KP
S17
CALCULATE θ
S18
CALCULATE NEXP
S19
θ ← PRVθ
RETURN

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FIG. 10

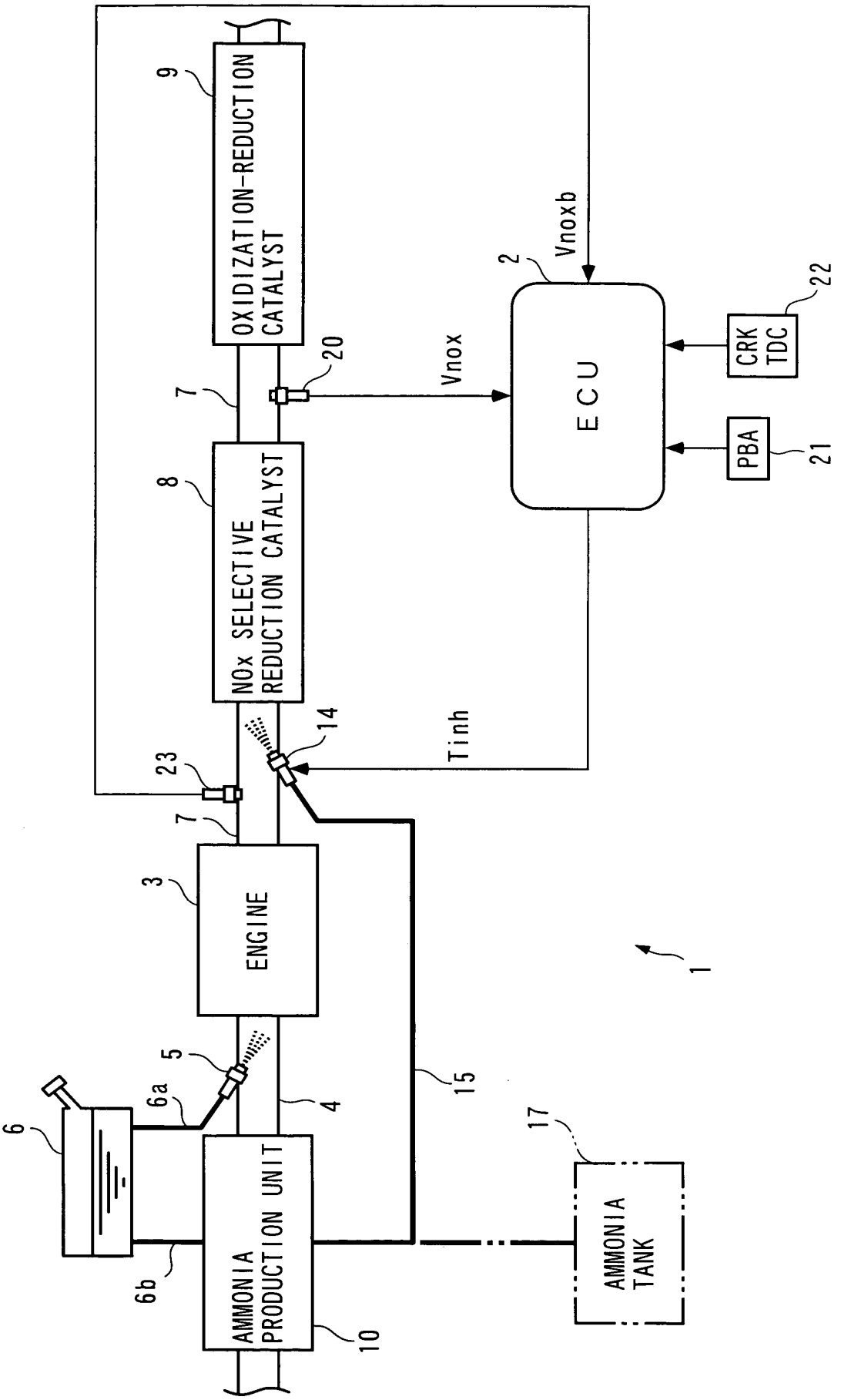


FIG. 11

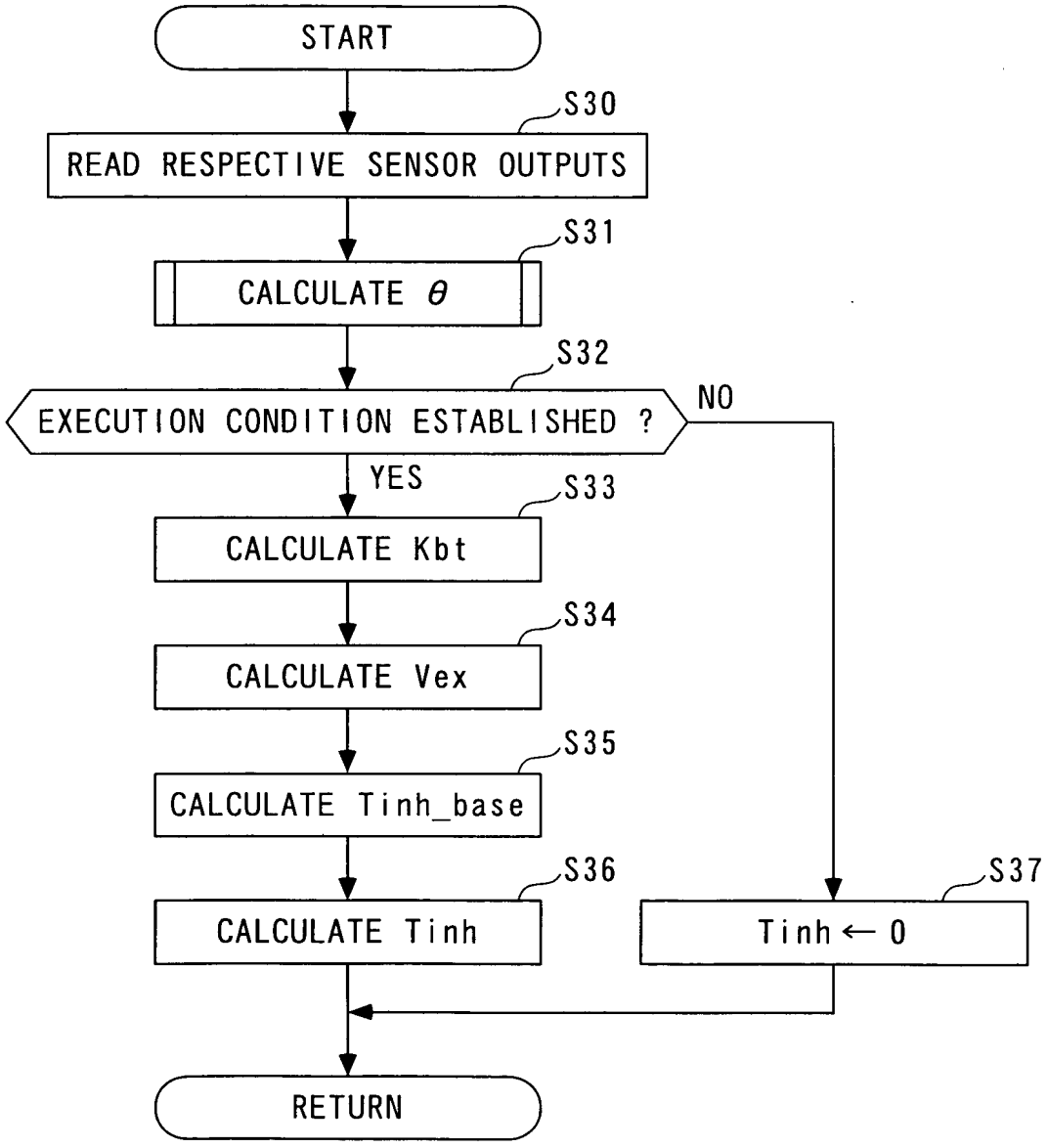
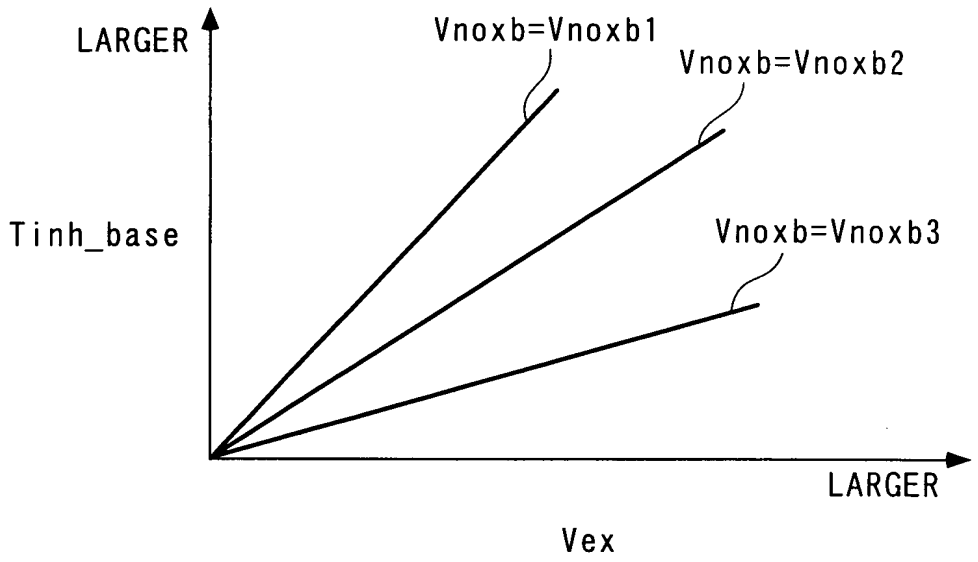

START
S30
READ RESPECTIVE SENSOR OUTPUTS
S31
CALCULATE θ
S32
EXECUTION CONDITION ESTABLISHED ?
NO
YES
S33
CALCULATE Kbt
S34
CALCULATE Vex
S35
CALCULATE Tinh_base
S36
CALCULATE Tinh
S37
Tinh ← 0
RETURN

FIG. 12


LARGER
Tinh_base
Vnoxb=Vnoxb1
Vnoxb=Vnoxb2
Vnoxb=Vnoxb3
LARGER
Vex